Abstract

Nowadays with the emergence of the IoT, less reliable and cheaper communication protocols, measurement devices are appearing besides the traditional communication and measurement methods. In these systems data loss is a possibility, this means that some of the samples may be incorrect.

Spectral analysis is one of the common tools in electrical engineering. Traditionally, DFT is used for this calculation, but it cannot be evaluated precisely when data loss occurs. Usually, is is not possible to wait for a full DFT block.

This paper reviews the phenomenon of data loss and two modeling approaches: the application of the indicator function and the non-equidistant sampling. The basic properties, functions of the data loss are described.

Three different approaches are presented for the spectral estimation of a signal with missing samples. The first one is the usage of DFT with some additional calculations. The second one is to model the signal and create an estimator based on this model. The third one is to view the signal as a non-equidistantly sampled one and use a method developed for the spectral estimation of the non-equidistantly sampled signals. The paper describes new methods, namely the controlled AFA, the harmonic DCDFT, CLEANEST and SLICK.

The above mentioned methods are analyzed from a theoretical point of view and tested by simulations. The thesis investigates the methods from the following aspects: computational complexity, required memory, used frequency grid, handling of the incoherent sampling, potential numerical problems and the possibility of a real-time implementation.

Simulations have been conducted to answer two questions. The first one is, how does the data loss affects the estimator calculated by the different methods. The second question is, how precisely the estimator identify the components of the original signal. The paper deals with both approaches. Recommendations are given for the choice of the spectral estimation method in different measurement circumstances.